

REMARKS

By the present amendment, the claims have been amended to replace “injector” by “injection means” as originally recited in claim 1, line 4, so as to provide antecedent basis, and claims 4, 6, and 12 have been amended to replace “characterized in that” by “wherein.”

Further, new claims 15 and 16 have been added to recite wherein the pressure of the gasoline supplied to the injector is more than 300 bars and wherein the pressure of the gasoline supplied to the injector is more than 300 bars and up to 2,000 bars, respectively. Support for the added recitations is found in the original application, for example, page 6, line 21.

Also, new method claims 17-23 corresponding to product claims 1-7 have been added. Since the present application is a U.S. national stage of an international application, it is submitted that the claims comply with the unity of invention requirement and should be examined together in this application.

Claims 1-23 are pending in the present application. Claims 1 and 17 are the only independent claims.

I. Objection to the abstract

In the Office Action, the abstract is objected to as being more than 150 words and as including legal phraseology such as “means” and “said.”

The abstract has been reduced to 147 words without legal phraseology as follows:

~~The invention relates to a~~ petrol internal combustion engine with controlled ignition, ~~comprising~~ includes at least one cylinder-(1), a cylinder head-(2), ~~sealing~~ sealing the cylinder-(1), a piston-(3), a combustion chamber-(4), ~~a petrol injection means~~-(5)

a petrol injector, an ignition-means (6) device, for production of an ignition of the air/petrol mixture in the combustion chamber, inlet (7) and exhaust-(8) valves, selectively sealing the combustion chamber-(4), an injection pump-(8), for supplying the injector-(5) with petrol under pressure, characterized in that the The pressure of the petrol, petrol provided to the injector-(5), exceeds 250 bars and that at least in one operating range for the engine subject to the phenomenon of knocking, the amount of petrol delivered by the pump-(8) to the injector-(5) for one combustion cycle is divided into a number of partial and distinct injections and at least one of said the partial injections is delivered before ignition of the charge in the combustion chamber-(4) by the ignition-means (6) device and at least one partial injection is delivered after said the ignition.

Accordingly, it is submitted that the objection should be withdrawn.

II. Obviousness rejections

In the Office Action, claims 1-8 and 10-14 are rejected under 35 U.S.C. 103(a) as obvious over US 6,138,638 to Morikawa ("Morikawa") in view of US 6,543,409 to Bertsch et al. ("Bertsch").

Further, claim 9 is rejected under 35 U.S.C. 103(a) as obvious over Morikawa in view of Bertsch and further in view of US 3,526,212 to Bassot ("Bassot").

The rejections are respectfully traversed. Contrary to the interpretation in the Office Action, the two partial injections in Bertsch take place before ignition (see Bertsch at col. 2, lines 1-5, or claim 17, for example).

More specifically, Bertsch does not explicitly discuss the timing of the second injection with regard to the ignition. The first injection of Bertsch takes place before ignition. Further, in the first part of the Bertsch patent, it is emphasized that the invention aims at improving a method known from German Patent DE 196 42 653, according to which, in stratified-mode

charge, the injection takes place along a variable period of time, leading to changing quality of the air-fuel mixture and hence to ignition problems. Bertsch solves this problem by providing two injection phases, at a well-known timing. There is nothing in that description that would have motivated or provided incentive to the person of the art toward addressing knocking problems and/or allowing high ignition advance time. In claim 3 of Bertsch, it is mentioned that the injection phase is carried out 50° to 5° before the top dead center position. However, Bertsch is silent as to the ignition timing.

More specifically, the Office Action refers to the sentence at col. 2, lines 1-5 of Bertsch as allegedly disclosing the second partial injection after ignition. This sentence of Bertsch states:

The main quantity of fuel initially introduced is prepared in an optimum manner [a] by the extended mixture formation time before ignition and [b] by the second pulse including the remaining quantity of fuel, and an undiluted combustible fuel/air mixture is formed.

It is respectfully submitted that the fact that Bertsch states that [a] is “before ignition” does not mean that [b] is implicitly after ignition. Rather, this sentence of Bertsch is better understood as meaning that the “preparation” of the “main quantity of fuel” (first partial injection) includes both [a] an “extended...time” before ignition, and [b] a “second pulse” (second partial injection), to result in an “undiluted combustible fuel/air mixture” that will be ignited.

In addition, the sentence at col. 2, lines 9-11 of Bertsch states: “Thus, an undiluted combustible fuel/air mixture that ensures initiation of ignition may be formed in the region of the spark plug.” This sentence refers to the “mixture” formed by the first and second partial

injection as described at col. 2, lines 1-5 discussed above. Thus, it is confirmed that, in the system of Bertsch, both partial injections must take place before initiation of ignition.

In contrast, the present invention addresses the problem of knocking phenomena, which can be avoided by splitting the injection before and after the ignition time. More particularly, an advantage of the present invention over Bertsch is that the second burst of partial injection after ignition makes it possible to effect quickly the formation of the air-gasoline mixture upstream of the flame front resulting from the combustion of the air-gasoline mixture prepared during the first burst of partial injections (as discussed in the present specification, for example, at page 5, lines 13-18). This further allows to maintain a relatively high ignition advance with the benefit of lower fuel consumption and ability to use cheaper ignition system.

The features of the presently claimed invention are not taught or suggested in any of the cited references, and a person of ordinary skill in the art would have had no motivation or other incentive to reach the features of the presently claimed invention. Therefore, the present claims are not obvious over the cited references taken alone or in any combination.

Further, regarding the dependent claims, the cited references fail to teach or suggest the combined features of each of these respective claims. Therefore, each of the dependent claims is not obvious over the cited references taken alone or in any combination.

In view of the above, it is submitted that the rejections should be withdrawn.

In conclusion, the invention as presently claimed is patentable. It is believed that the claims are in allowable condition and a notice to that effect is earnestly requested.

Amendment
US Appl. No. **10/551,825**
Attorney Docket No. **PSA05003**

In the event there is, in the Examiner's opinion, any outstanding issue and such issue may be resolved by means of a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number listed below.

In the event this paper is not considered to be timely filed, the Applicants hereby petition for an appropriate extension of the response period. Please charge the fee for such extension and any other fees which may be required to our Deposit Account No. 502759.

Respectfully submitted,

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